



## On two Psolidae (Echinodermata: Holothuroidea) from the Gulf of California, Mexico

### Dos Psolidae (Echinodermata: Holothuroidea) del golfo de California, México

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**Abstract.** Two species of holothuroids of the family Psolidae have been collected in the Gulf of California, Mexico. *Psolus diomedae* Ludwig, 1894, a species previously known from the Pacific coast of Mexico and abundant in the Gulf of California was collected in 3 stations, in a depth range of 58 to 260 m. *Lissothuria hancocki* (Deichmann, 1941), previously reported for the California Current and the Gulf of California, was collected in one station at 260 m depth, together with *P. diomedae*.

**Key words:** Holothuroids, Psolidae, Gulf of California, Mexico.

**Resumen.** Se recolectaron 2 especies de holotúridos de la familia Psolidae en el golfo de California, México. *Psolus diomedae* Ludwig, 1894, una especie previamente registrada en el Pacífico mexicano y abundante en el golfo de California fue encontrada en 3 estaciones, en un intervalo batimétrico de 58 a 260 m. *Lissothuria hancocki* (Deichmann, 1941), citada previamente para la zona de la corriente de California y en el golfo de California, fue recolectada en una estación, a 260 m de profundidad, junto con *P. diomedae*.

**Palabras clave:** Holoturoideos, Psolidae, golfo de California, México.

## Introduction

The Holothuroidea of the Gulf of California have been reviewed by Solís-Marín et al. (2009) who reported 55 shallow and deep-water species. More recently, Massin and Hendrickx (2010, 2011) studied a collection of 71 specimens collected below 300 m depth during the TALUD cruises (1991-2009) in the same area and off the SW coast of Mexico, and reported 13 species, including 3 species new to science. Based on their studies and a compilation of previous literature, Massin and Hendrickx (2011) reported 31 species known from off the Pacific coast of Mexico, of which 20 have been recorded in the Gulf of California.

Much information related to the echinoderms of the eastern Pacific is available in a compilation of taxonomic and distributional data presented by Maluf (1988). Although this compilation is now over 30 years old and many taxonomic and classification changes have occurred since, it is still a valuable document for the study of echinoderms in the region. Maluf (1988) included 627 entries in a review, each corresponding to a species, subspecies or unidentified genus that were known at that

time, from the intertidal to 7 720 m depth. Of these, 150 belong to the Holothuroidea.

When information provided by Maluf (1988), Solís-Marín et al. (2009) and Massin and Hendrickx (2011) are put together, there are 16 species of Psolidae with 1 or more records in the eastern Pacific, 7 of which have been cited from off the Pacific coast of Mexico: *Lissothuria hancocki* (Deichmann, 1941), from the California Current and the Gulf of California (depth range: from 5 to 302 m); *L. ornata* Verrill, 1867, from the California Current and the southern Gulf of California (depth range: from the intertidal to 36 m); *Psolidium dorsipes* Ludwig, 1886, from the northern and southern Gulf of California (depth range: 6-110 m); *P. gracile* Ludwig, 1894, from the southern Gulf of California (depth range: 377-3 075 m); *Psolus diomedae* Ludwig, 1894, from the California Current and the Gulf of California (depth range: 7-302 m); *P. squamatus* (Koren, 1844), from the southern Gulf of California and SW Mexico (depth range: 7-1 237 m). The seventh species, *Lissothuria nutriens* (H.L. Clark, 1901), is reported as doubtful for the Gulf of California and the Galapagos Islands by Maluf (1988). Pawson (1967) does not consider any of these 2 records in the distribution of this species, and considered it as only a Californian

species. In the particular case of *P. squamatus*, Massin and Hendrickx (2011) briefly discussed the taxonomic complexity of the species of the “*squamatus*” complex, noting that further studies using molecular phylogeny are needed to elucidate the relationships among these and their geographic distribution.

Specimens of Psolidae available in the Laboratorio de Invertebrados Bentónicos, Instituto de Ciencias del Mar y Limnología, UNAM, were examined during this study. The specimens belong to 2 species of Psolidae which are reported herein.

### Materials and methods

The single specimen of the CORTES 2 cruise was found in a sediment sample collected with a 40 liters Van Veen dredge. Specimens obtained during the GUAYTEC I cruise were sampled with an 11.6 m commercial otter-trawl (5.7 cm stretched mesh). In both cases, sampling operations were carried out on the vessel R/V “El Puma”, of the Universidad Nacional Autónoma de México (UNAM). The CORTES 2 cruise was organized by the Laboratorio de Invertebrados Bentónicos, Instituto de Ciencias del Mar y Limnología (ICML), UNAM, and the GUAYTEC I cruise by the ITESM (Instituto Tecnológico de Estudios Superiores de México), Guaymas, Mexico. The Cabo Haro material was found among fishes collected by the ITESM during a routine survey. Specimens were separated from the catch and fixed with formaldehyde, washed and preserved in 70% ethanol for permanent conservation.

The specimens have been deposited in the Regional Marine Invertebrates Collection of the ICML, UNAM, in Mazatlán, Mexico (EMU), and in the collection of

Holothuroidea at the Royal Belgian Institute of Natural Sciences (IG/HOL), in Brussels, Belgium. Abbreviations used are: St., sampling station; TL, total length; coll., collector.

### Redescriptions

Psolidae Burmeister, 1837

*Psolus* Oken, 1815

*Psolus diomedae* Ludwig, 1894

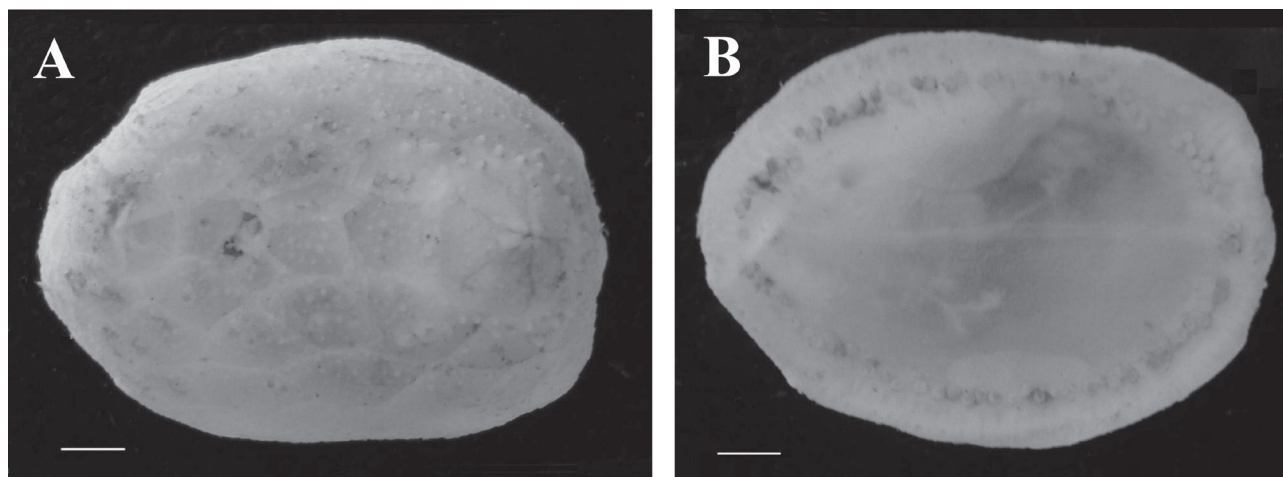
Figs. 1, 2

*Psolus diomedae* Ludwig, 1894: 136, tab XIV, Figs. 1-3; Fisher, 1907: 717; Deichmann, 1941: 149, Pl. 30, Figs. 9-10; Maluf, 1988: 88, 152 (list of references); Solís-Marín et al., 1997: 256 (list); 2005: 131 (list); Maluf and Brusca, 2005: 343 (list); Honey-Escandón et al., 2008: 66 (list).

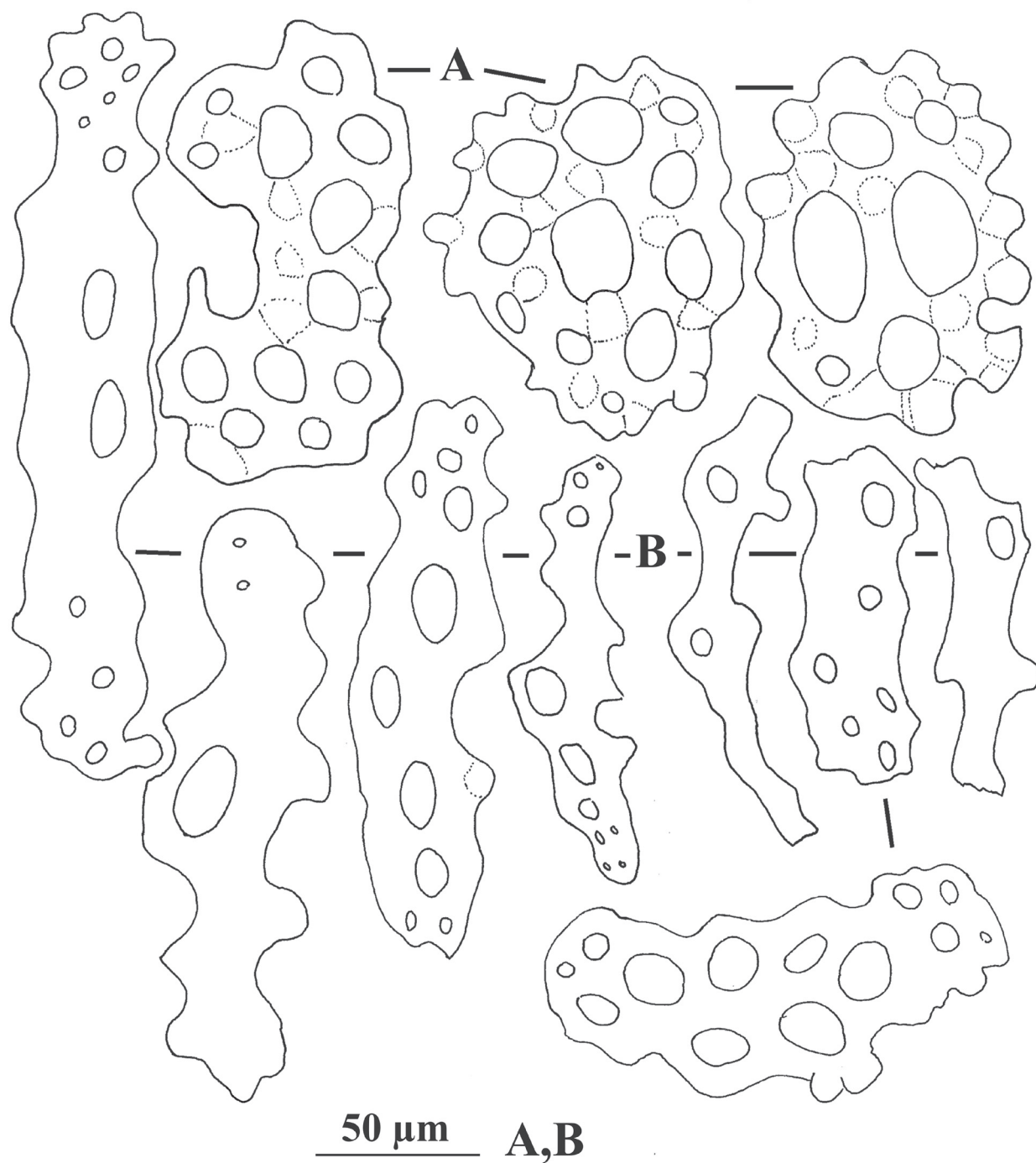
*Psolus diomedae*.- Solís-Marín et al., 2009: 54, Pl. 2A-D.

*Psolus conchae* Caso, 1968: 3, Pls. 1-4, Figs. 1-7 + 1 map; Maluf, 1988: 152; Solís-Marín et al., 2009: 54.

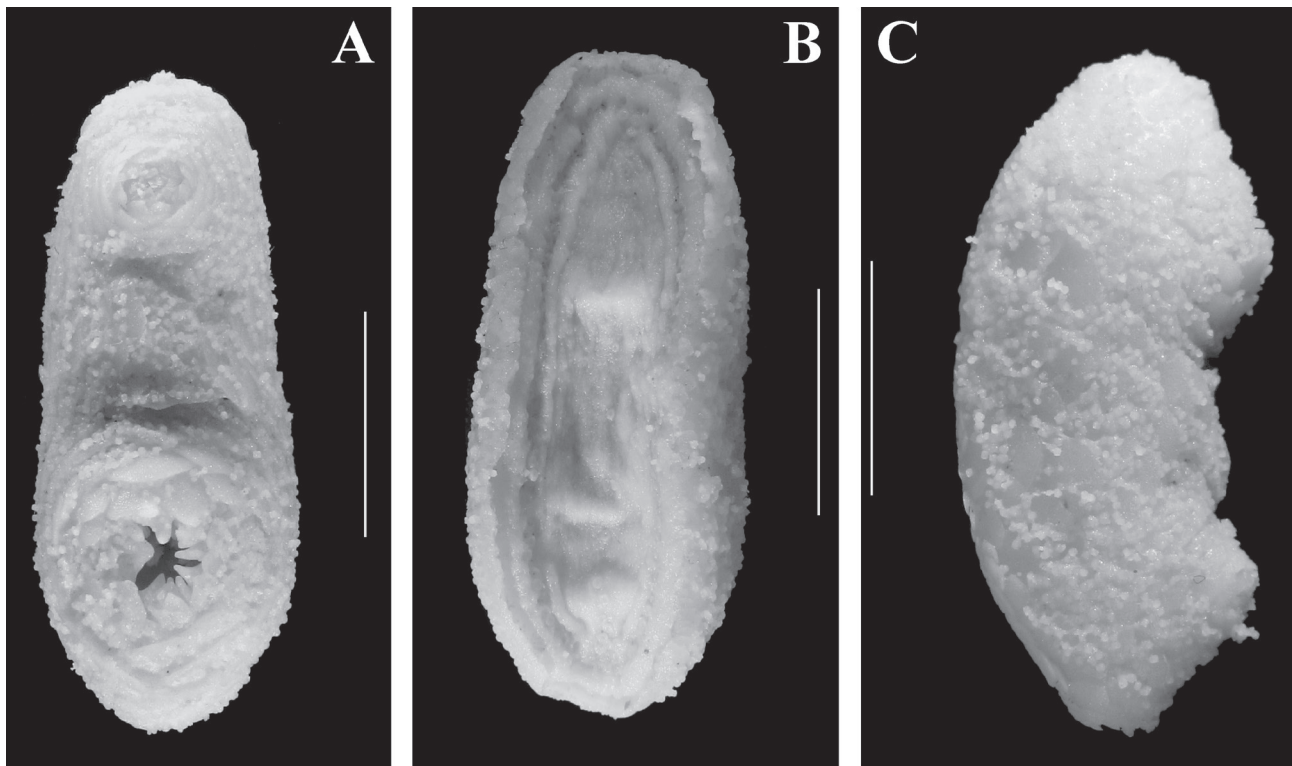
Body oval to nearly round. Dorsal side covered by large scales. Mouth and anus closed by 5 triangular plates which form a pyramid (Fig. 1A); 2-3 large plates between mouth and anus. All the dorsal plates covered by granules. Ventral sole thin, some part of the gut visible by transparency. Ventral tube feet all around the sole; no tube feet in the mid-ventral row (Fig. 1B). *Ossicles*: the ventral sole is characterized by nodulous plate, 110-140 µm long, perforated by 6-10 holes (Fig. 2A). The ventro-lateral tube feet are stuffed with perforated rods, 40-260 µm long (Fig. 2B). The end plate is made of 1 piece 260-300 µm across. The large plates of the dorsal body wall are 240-3 400 µm across and covered by large granules. These plates are multilayered, except at their edge.



**Figure 1.** *Psolus diomedae* Ludwig, 1894 (IG 31929/HOL 1524). A, dorsal view; B, ventral view. Front is to the right. Scale bar= 2 mm.



**Figure 2.** *Psolus diomedae* Ludwig, 1894. A, nodulous plates of the ventral sole; B, rods of the ventro-lateral tube feet.



**Figure 3.** *Lissothuria hancocki* (Deichman, 1941) (EMU-9430-A). A, dorsal view; B, ventral view; C, lateral view. Scale bar= 1 cm.

#### *Taxonomic summary*

**Material examined.** One specimen (TL 16 mm), CORTES 2 cruise, St. 46, off Estero Tastiota (28°09'24" N, 111°40'42" W), 18-Mar-1985, Van Veen dredge, 99 m (EMU-9427).

One specimen (TL 18 mm) (IG 31929/HOL 1524) and 2 specimens (TL 13 and 19 mm) (EMU-9428), 2.24 miles south of Cabo Haro (27°48'N, 110°53'W), Guaymas, Sonora, 15-Oct-1992, 32-45 fm (58-81 m) (coll. L. Findley). Four specimens (TL 12-18 mm) (IG 31929/HOL 1523 and IG 31929/HOL 1521) and 12 specimens (TL 10-22 mm) (EMU-9429), GUAYTEC I cruise, St. 11, Canal de Salsipuedes (28°29'42" N, 112°48'48" W), Baja California, Mexico, 14-Feb-1987, R/V "El Puma", benthic dredge, 260 m depth (coll. L. Findley).

**Remarks.** The specimens of *Psolus diomedae* at hand fits perfectly with the figures of Ludwig (1894, Pl. xiv, Figs. 1, 2). It is a well known species, easy to identify with its nearly rounded body and the few dorsal plates between mouth and anus. The species is common in the Gulf of California (Solís-Marín et al., 2009).

*Lissothuria* Verrill, 1867

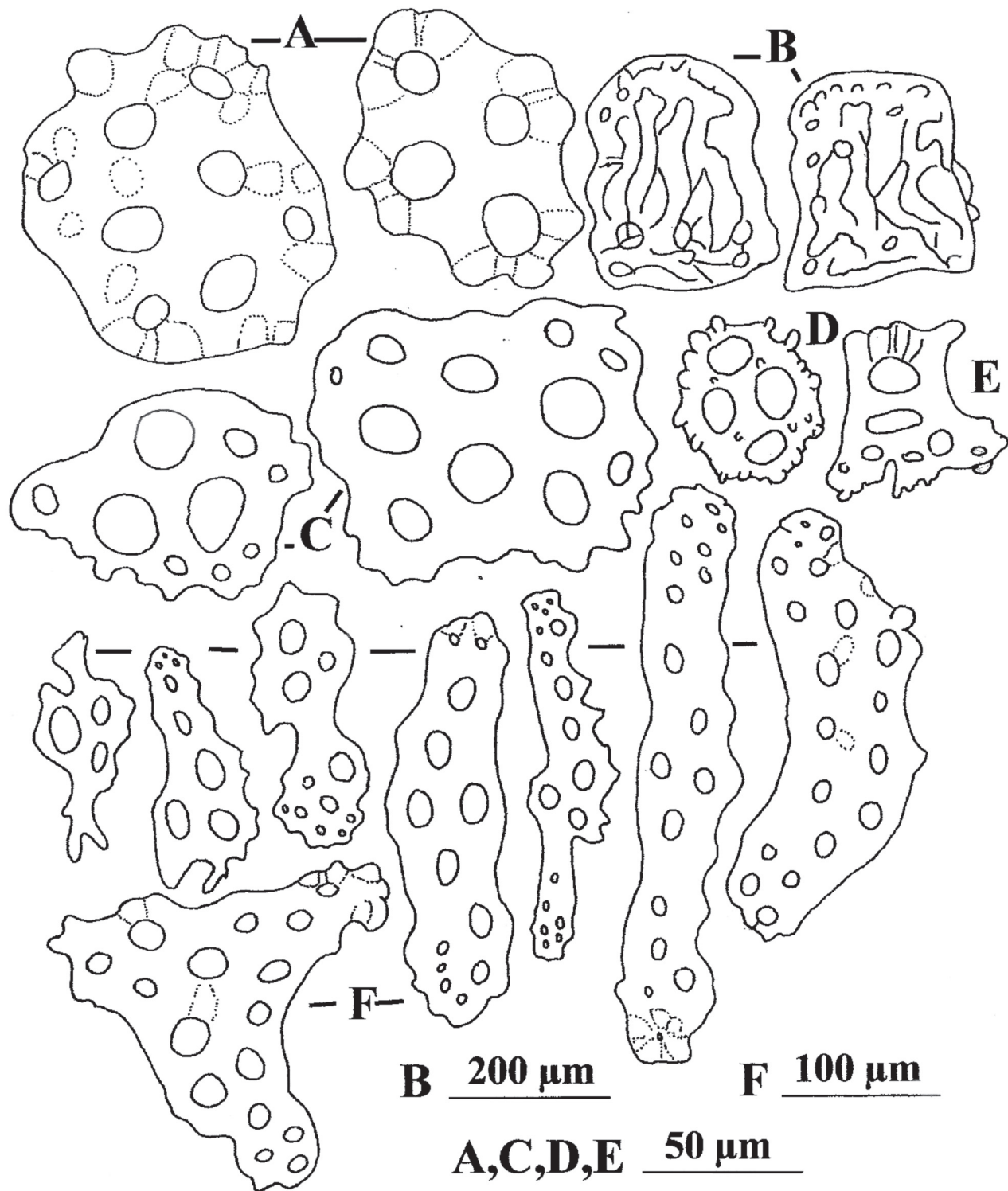
***Lissothuria hancocki*** (Deichmann, 1941)  
Figs. 3, 4

*Thyonepsolus hancocki* Deichmann, 1941: 140, Pl. 27, Figs. 1-7.

*Lissothuria hancocki*.- Pawson, 1967: 16; Maluf, 1988: 87, 152 (list of references); Maluf and Brusca, 2005: 342 (list). *Description based on specimen* (IG 31929/HOL 1522).

The specimen is 24.2 mm long, width 11.5 mm and height 10.0 mm (Fig. 3A). Dorsally large plates, up to 3.0 mm long, covered by numerous towers (Fig. 3A). These towers give a granulose aspect to the dorsal body wall (Fig. 3A, C). As for the type material (Deichmann 1941: 141) the dorsal tube feet are rudimentary and not countable. Oral and anal cones well developed (Fig. 3C) covered by numerous small scales; 8-10 plates between mouth and anus (see remark below). Ventral sole (Fig. 3B) thick; large tube feet crowded on 2 rows laterally (Fig. 3B) with more or less 35 tube feet in each row; the mid-ventral row with scattered tube feet (Fig. 3B). **Ossicles:** in the ventral sole only large plates (80-160 µm long), knobbed, perforated by 4 -10 holes (Fig. 4A). In the dorsal body wall large scales present (700-3 000 µm long), multilayered, circular triangular or rectangular. They are covered by numerous large towers (300 µm height, 250 µm across) (Fig. 4B). In the dorsal tube feet small perforated plates (Fig. 4C) with blunt spines at the edge, knobbed cups (Fig. 4D) and hourglass shaped bodies (Fig. 4E). In the large ventral





**Figure 4.** *Lissothuria hancocki* (Deichmann, 1941). A, knobbed perforated plates from ventral sole; B, towers of dorsal body wall; C, perforated plates from dorsal tube feet; D, knobbed cups from dorsal tube feet; E, hourglass-shaped bodies from dorsal tube feet; F, perforated rods from ventral tube feet.

tube feet, numerous perforated rods (Fig. 4F), 130-360  $\mu\text{m}$  long, some triangular (Fig. 4F). End plate in 1 piece, 100-110  $\mu\text{m}$  across.

#### Taxonomic summary

**Material examined.** One specimen (TL 24 mm) (IG 31929/HOL 1522) and 3 specimens (TL 9-26 mm) (EMU-9430-A, 9430-B), GUAYTEC I cruise, St. 11, Canal de Salsipuedes (28°29'42" N, 112°48'48" W), Baja California, Mexico, 14-Feb-1987, R/V "El Puma", benthic dredge, 260 m depth (coll. L. Findley).

**Remarks.** According to Pawson (1967) there are 8 species in the genus *Lissothuria* and *L. hancocki* differs from all the other species by the reduced number of tube feet in the midventral radius. It is also characterized by its large towers. The largest of the 3 specimens of the second subsample (EMU-9430-A) presents the typical large plates with towers on the dorsal face, the reduced number of tube feet in the midventral row, and over 30 tube feet in each lateral row.

The material examined herein consisted of small specimens of *L. hancocki* (9-26 mm long) whereas Deichmann (1941) observed specimens up to 40 mm long. For the largest specimens of Deichmann there are ca 14 dorsal scales between mouth and anus, and only 8-10 for our specimens. This difference could be related to the body size of the specimens. It is well known that with increasing body size, ossicles and number of tube feet of sea cucumbers present variations (Massin 1992; 1994).

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